Summary

The valley elderberry longhorn beetle (VELB), *Desmocerus californicus dimorphus* Fisher (Coleoptera: Cerambycidae), is patchily distributed throughout the Central Valley from Redding to the Bakersfield area. During this survey evidence of the VELB was found at about 28 percent of 230 sites with *Sambucus*, and in about 20 percent of 504 groups of elderberry at those sites. Of those with exit holes, recent (current year) holes were present at about 52 percent of 64 sites, and in about 45 percent of 103 groups of elderberry. Four adult beetles were collected at three sites in the eastern Central Valley. No evidence of the VELB was seen at several localities where it had been previously reported.

Elderberry shrubs/trees with VELB populations occur in a variety of habitats and plant communities, but most often in riparian or savanna areas. Two species of elderberry, *Sambucus mexicana* Presl. and *S. racemosa* L. var. *microbotrys* (Rydb.) Kearney & Peebles, serve as hosts for the beetle. The VELB inhabits elderberry of various sizes, ages, and growth forms. Those with many exit holes were most often large, mature plants; young stands were seldom infested. Emergence holes were most frequently found in healthy, unstressed plants.

An assortment of branch sizes are utilized for larval development and pupation. Fifty percent of those measured in this survey were 2-4 inches in diameter at the exit hole. However, some smaller than 1.5 inches in diameter were encountered infrequently, the smallest being 0.6 inches.

The valley elderberry longhorn beetle appears to be either a poor disperser or very host plant selective. The beetle was most likely to occur in situations where plants were not isolated from one another. In addition, it seems to be only locally common, i.e., found in population clusters which are not evenly distributed across available *Sambucus*. Frequently only particular trees or clumps in an area harbored the VELB, and other similar ones nearby were unaffected. The infested plants usually showed evidence of utilization over a period of several years, but sometimes only one or two exit holes were present. The reason for the selection of particular plants as hosts is not known.

Introduction

TAXONOMY

Desmocerus californicus was described by Horn in 1881 from a specimen collected in southern California, and is known only from California. The valley elderberry longhorn beetle (VELB) was first described as a separate species, *Desmocerus dimorphus* Fisher (1921), based on the distinctive coloration of the males; Sacramento was the type locality. Subsequently Linsley and Chemsak (1972) recognized the two as subspecies, and designated the latter as *D. californicus dimorphus* Fisher.

The subspecies are separated on the basis of distribution and the color pattern of the males. The male of *D. c. dimorphus* (Figure 1) is described as usually having the dark pattern of the elytra reduced to 4 oblong spots, and the basal segments of the antennae usually clothed with pale hairs. Conversely, the male of *D. c. californicus* has the dark pattern of elytra occupying most of the surface, and dark hairs on the basal segments of the antennae (Linsley and Chemsak 1972). The males of the latter subspecies are slightly larger on the average. Females of both have color patterns similar to the males of *D. c. californicus*, with dark elytra bordered in red or reddish orange (Figure 2), and are difficult or impossible to separate on the basis of morphology alone. A small percentage of male *D. c. dimorphus* also have an elytral pattern identical to that of the nominate subspecies.

Halstead (1990, 1991a) believes that *D. c. dimorphus* should be designated as a junior synonym of *D. californicus*. He claims that the two are merely color variants exhibiting the character extremes of a single species, and that "the characters used to distinguish the subspecies are not valid due to the great amount of variability, intergradation, and overlap." His work has not yet been published in a scientific journal, and prevailing opinion presently supports the current subspecific status of the VELB (Chemsak pers. comm.).

DISTRIBUTION

Linsley and Chemsak (1972) reported the range of *D. c. dimorphus* to be from the lower Sacramento Valley to the upper San Joaquin Valley (Figure 3). At that time nearly all records were from specimens

(Figure 3). At that time nearly all records were from specimens collected in the Sacramento and Davis areas. Since then the known range of the beetle, based on adult specimens, has been extended northward along the Sacramento River almost to Red Bluff in Tehama County (Jones and Stokes 1985, 1986, 1987b). The westernmost records are from Yolo County along Putah Creek just below Lake Berryessa (Schuster 1984). Halstead (1990) has taken adults as far southeast as the upper Kaweah River in Tulare County, and has examined specimens from the U. S. National Museum which were collected by H. K. Morrison, probably in 1880 (Shields 1990a), and labeled simply "Kern County." Adults have been collected at elevations ranging from 30 feet on the Central Valley floor to about 2200 feet in the Sierra Nevada (Halstead 1990).

In addition to adult records, the range has been further expanded by exit hole reports. Halstead (1990) found exit holes along the Sacramento River almost as far north as the Shasta/Tehama County line, and they were reported by Holland (1985) from along the Feather River in Yuba County. The most southeastern records were from along Caliente Creek in Kern County by Shields (1990b, 1990c).

The nominate subspecies, *D. c. californicus*, primarily inhabits the coast and Coast Ranges from Mendocino County southeast to Los Angeles and Riverside counties (Linsley and Chemsak 1972) (Figure 3), but there are a few isolated records from Trinity, San Diego, and eastern San Bernardino counties (Halstead 1990). Andrews et al. (1987) identified as this subspecies specimens from along Los Banos Creek (Merced County) in the eastern foothills of the Coast Range at an elevation of 400-440 feet.

It is not known if the ranges of the subspecies are parapatric, or adjoining; if so, hybrids or intergrades can be expected in the zone where this occurs.

LIFE HISTORY

Although there has been no detailed study of its life history and ecology, many independent observations have contributed to the current body of knowledge about *D. c. dimorphus*. The beetle has been found only in association with its host plant, elderberry (*Sambucus* spp.). Adults feed on the foliage and perhaps flowers, and are present from March through early June. The largest percentage of specimens have been collected in May. During this period the beetles mate, and the females lay eggs on living elderberry plants. The eggs are about 2.5-3.0 mm long, reddish brown, and are shaped like an elongate football with longitudinal ridges. The female places the eggs singly or in small groups in bark crevices or at the junctions of stem/trunk or leaf petiole/stem (Halstead 1991a). Upon eclosing, the first instar larva

undetermined amount of time, creating a characteristic gallery which is filled with frass and shredded wood (Figures 4, 5). The mature larva pupates in an enlarged pupal chamber within the tunnel. After transforming into an adult, it chews an exit hole and emerges from the elderberry (Chemsak pers. comm.). The life cycle of the VELB has been assumed to encompass two years, but recent information from rearing experiments suggests that a one year cycle is possible, if not probable (Halstead 1991a).

Valley elderberry longhorn beetle exit holes are circular or slightly oval and are usually 7-10 mm in diameter (Figures 6, 7, 13). Although there are many insects which burrow in wood for at least part of their life cycle, none other than the VELB are known to inhabit live elderberry wood and/or make exit holes of a similar size and shape in the Central Valley (Nagano 1989). The range of another species, *Desmocerus auripennis auripennis* Chevrolat, may overlap that of the VELB in the Sierra Nevada where it has been recorded from as low an elevation as 3500 feet. However, it is a much larger and more robust species and its exit holes would likewise be larger.

VELB emergence holes have been observed in shoots or branches with diameters as small as 0.5 inches (13 mm) (Halstead 1991a), to as large as 8 inches (Jones and Stokes 1985, 1986, 1987b). Jones and Stokes (1985, 1986, 1987b) also reported that more than 70 percent of the holes they found on the upper Sacramento River were located at 4 feet or less stem height.

HABITAT

Because of problems with the taxonomy of *Sambucus* (Caprifoliaceae) resulting from phenotypic variability, possible hybridization, and the need for a generic revision, the species serving as host(s) for the VELB has/have been in question. *Sambucus glauca* Nutt. was given as the host for both subspecies of *D. californicus* by Linsley and Chemsak (1972); both *S. mexicana* Presl. and *S. caerulea* Raf. have also been suggested as possible hosts (USFWS 1984).

Elderberry is a common component of the remaining riparian forests and adjacent grasslands of the Central Valley. It grows in association with various species of woody plants, depending on the locality, such as Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), willow (*Salix* spp.), oak (*Quercus* spp.), boxelder (*Acer negundo*), Oregon ash (*Fraxinus latifolia*), wild grape (*Vitis californica*), and poison oak (*Rhus diversiloba*) (USFWS 1984). *Sambucus mexicana* is the characteristic species of the Elderberry Savanna (Holland 1986) which borders riparian forests in some areas.

Almost 90 percent of the riparian habitat in California has been lost to agricultural and urban development during the last 150 years. It has been conservatively estimated that these forests formerly covered 922,000 acres in the Central Valley; an aerial survey in 1979 revealed that only about 102,000 acres remained at that time. Although little is known about the historical distribution and abundance of the VELB or its foodplant, extensive destruction of the riparian forests strongly suggests that the range of the beetle has been reduced and greatly fragmented (USFWS 1984). The earliest study of the distribution and status of *Desmoscerus c. dimorphus*, by Eya (1976) during 1975 and 1976, concluded that it was rare, localized, and in need of protection. That view has been shared by Dr. John Chemsak at University of California at Berkeley, an expert on the Cerambycidae (**Federal Register** 45:52803-52807)

FEDERAL PROTECTION

On August 10, 1978, the U. S. Fish and Wildlife Service (USFWS) proposed that *Desmocerus californicus dimorphus* Fisher be listed as threatened, with Critical Habitat (**Federal Register** 43:35636-35643); it was listed as such on August 10, 1980 (**Federal Register** 45:52803-52807). The two areas designated as Critical Habitat are both along the American River in the greater Sacramento metropolitan area.

A Recovery Plan published by the U. S. Fish and Wildlife Service in 1984 summarized the known aspects of the taxonomy, biology, distribution, and habitat/population decline of the beetle. Most importantly, the Plan detailed steps to protect the VELB and its habitat, and to gather additional information. Other than the Critical Habitat, two areas were designated as Essential Habitat: a portion of Putah Creek in Solano County, and the American River Parkway below Nimbus Dam in Sacramento County. An implementation schedule was included for the recovery process.

PREVIOUS STUDIES, 1984-1991

Since 1984 there have been several studies investigating the distribution, habitat, and life history of the VELB.

Under contract with the California Department of Fish and Game (CDFG), Arnold (1984) surveyed sites along the lower American River and several waterways in the lower Sacramento and upper San Joaquin valleys. Adult beetles were collected and/or observed along the American River.

Exit holes were found in Sacramento County along the Cosumnes River and Dry Creek; in San Joaquin County along Bear Creek, the Calaveras and Middle rivers; in Stanislaus County along the San Joaquin and Tuolumne rivers; and in Merced County along the Merced River. Working independently in 1985, Arnold reported adults from localities along the Sacramento River near its junction with the Feather River (Yolo County), Putah Creek (Solano County), and the Calaveras, Middle, Mokelumne (San Joaquin County), and Merced (Merced County) rivers. Unfortunately detailed reports and specific locality information are unavailable, and specimens collected have not yet been deposited at the University of California at Berkeley as Arnold (1985) stipulated.

Kellner found exit holes at a site on the Sacramento River in Broderick (Larry Seeman Associates 1985b) (also noted by Arnold 1986), and the American River at Sacramento Bar in Fair Oaks (Larry Seeman Associates 1985a). He also surveyed some areas along the San Joaquin River for a U. S. Army Corps of Engineers (COE) project (Environmental Science Associates 1985) but found no evidence of the VELB.

Nimbus Flat at Lake Natoma, part of Folsom Lake State Recreation Area, was surveyed for the valley elderberry longhorn beetle by the California Department of Parks and Recreation (CDPR); adults and exit holes were observed (Showers 1987, Singleton 1987).

Jones and Stokes (1987a) found exit holes, but no adults, during a survey of three tracts of land along the Cosumnes River southwest of Sloughhouse. Jones and Stokes also conducted a comprehensive three-year survey of 183 miles of the Sacramento River from its confluence with the American River in Sacramento, north to the Red Bluff Diversion Dam (Jones and Stokes 1985, 1986, 1987b). During this time 10 adults were collected from Knights Landing (Yolo County) to Proberta (Tehama County). Exit holes were found as far north as 3.5 river miles south of the Diversion Dam.

A stretch of Los Banos Creek (Merced County) from 400-800 feet in elevation, due to be impacted by Los Banos Grandes Reservoir, was inventoried by Andrews et al. (1987). Over a two month period only two adult specimens were collected, a male and a female. Although identified as the unprotected, nominate subspecies, *D. c. californicus*, it is possible that the single male could be the atypical dark form of *D. c. dimorphus*, a hybrid, or an intergrade. The beetles and numerous exit holes were found at an elevation of 400-440 feet.

In 1990, Shields conducted a field survey for the U. S. Fish and Wildlife Service in Kern County and reported finding exit holes at five sites along the Kern River, Poso Creek, and Caliente Creek (1990b, 1990c).

Halstead (1989, 1990, 1991a, 1991b, 1991c), working for the Kings River Conservation District, has been studying the VELB primarily from Merced County to Tulare County. He has taken adult specimens along the

Merced River, Kings River, West Fork Byrd Slough, Middle Fork Kaweah River, and in and near the town of Coarsegold (Madera County).

Reports from various other individuals and consultants, primarily to the California Department of Fish and Game (CDFG) Natural Diversity Data Base (NDDB), have supplied additional records. Of these, California Department of Transportation (CALTRANS) workers Ford and Villa (1987) were notable for reporting exit holes from Red Bluff, the most northern record at the time.

CURRENT STUDY

The primary goals of this status review have been: (1) to survey significant riparian vegetation in the Central Valley and foothills of the bordering mountains to determine the range of the valley elderberry longhorn beetle, and the maximum altitude at which it occurs; (2) to determine the habitat and ecological conditions preferred by the VELB by ascertaining the size, condition, and taxonomic identity of the elderberry host plants, and size and condition of riparian habitats utilized; (3) to record life history and behavioral information acquired from adults encountered, and from exit holes and infested wood examined; (4) to determine the amount of habitat that is currently protected in areas such as parks, refuges, and preserves; (5) to detail specific threats to the existence of the VELB, and to provide recommendations for its continued management and protection.